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PALYNOLOGY OF SURFACE SAMPLES
FROM KAMINAK LAKE AREA,
NORTHWEST TERRITORIES, CANADA

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PALYNOLOGY OF SURFACE SAMPLES FROM KAMINAK LAKE AREA, NORTHWEST TERRITORIES, CANADA

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Abstract

Pollen spectra from surface samples of terrestrial deposits (collected at sites about 80 km northeast of tree line) contain about 15% spruce pollen and about 25% pine pollen. The rest of the spectra reflect rather well the local characteristics of the tundra vegetation. Pollen is preserved in tundra peat and shallow pond deposits, and can be transported by surface water run-off in the arctic landscape to be redeposited in alluvial and lacustrine sediments. A comparison of surface pollen spectra from lacustrine and terrestrial deposits shows that they are similar in general characteristics. However, those from lacustrine deposits do not reflect well the local variations in

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the tundra plant communities.

INTRODUCTION

About ten years ago J. C. Ritchie and S. Lichti-Federovich made a comprehensive palynological study of surface samples collected from more than a hundred sites extending from southern Manitoba grassland to the tundra at Baker Lake in the Northwest Territories. For the purpose of data comparison only lake sediments were used, and a set of six samples from the deepest part of the basin was collected in all lakes that were selected on the basis of similar size and morphometry (Lichti-Federovich and Ritchie, 1968).

These authors found that there was a direct correlation between the palynomorph spectra (obtained from lake sediments) and the broad biogeographical types of vegetation within the region studied. They recommended that "wherever Quaternary spectra are abstracted from lake-sediment cores, Recent spectra for comparative interpretation should be derived from lake muds". The authors recognized that surface samples of humus and peat can yield rich palynomorph assemblages that reflect sensitively the various local plant communities of arctic landscape, but they felt that disparities between Recent pollen spectra caused by sampling different polliniferous matrices precluded direct comparisons of their data and the results of studies of typical regional pollen spectra of the major vegetation zones elsewhere.

It has been common practice in studies of Quaternary stratigraphy, particularly in arctic Canada, to use supporting palynological information obtained from samples of surficial deposits exposed in river banks, seashore bluffs, and less frequently in bluffs along shores of large lakes. Rarely do such exposures contain sediments that were originally deposited in small lakes.

The present study was made for the purpose of comparing surface palynomorph assemblages extracted from terrestrial deposits (peat, soil) and those obtained by Ritchie from lacustrine sediments in the same region of tundra west of Hudson Bay.

THE KAMINAK LAKE AREA

The landscape characteristics of the Kaminak Lake area (Text-fig.1) are controlled by the bedrock surface of the Canadian Shield that has been somewhat modified by glacial erosion and deposition (Lee, 1959). The cover of surficial deposits is discontinuous and the Quaternary geomorphological features include eskers, drumlins, ribbed- and end-moraines, ice-contact deltas, raised beaches, alluvial deposits, and sediments of the Tyrrell Sea (related to the marine submergence of the area during and after deglaciation). The highest marine shorelines are at about 170 meters above the present sea level and only a few small hills in the Kaminak Lake area extend above that elevation. These hills were islands in the Tyrrell Sea.

According to Shilts (1973) the oldest reliable date on Tyrrell Sea sediments in the Kaminak area is 6600 + 230 radiocarbon years before present (GSC-1434).

This region, which is part of the District of Keewatin, N.W.T., is underlain by permafrost and various types of frost features (for example, patterned ground) are common.

The approximate northern limit of trees (indicated by the broken line in Text-figure 1) and other forest region boundaries are adopted from the report by Rowe (1959). There are considerable local deviations from the generalized limit of trees, depending on the more detailed physiographic characteristics of the landscape that favour better snow cover, give protection from strong winds, and provide south facing slopes with more clement microclimate.

The Kaminak Lake area is north of the limit of trees and as pointed out by Lichti-Federovich and Ritchie(1968), remarkably little is known about the vegetation of this region. These authors state that "the region as a whole is characterized by dwarf shrub-lichen vegetation on upland sites, dominated by *Betula glandulosa*, *Ledum decumbens*, *Vaccinium uliginosum*, *Arctous alpina*, and *Salix*, with a prominent moss and lichen component. Poorly drained sites are occupied by communities dominated by *Eriophorum*, *Carex*, *Scirpus*, and various grasses".

A more detailed floristic and ecological study of vegetation in the Ennadai Lake, Dubawnt Lake, and Yathkyed Lake (which is closer to Kaminak Lake) areas was made by Larsen (1965). This study contains lists of species and numerical data on the frequency of species occurring in the different plant communities described by Larsen. Results of this study are applicable to the Kaminak Lake area.

PALYNOLOGICAL STUDIES

Surface samples for the present study were collected from two sets of sites (Text-fig. 1): one in the northern Kaminak Lake area; the other south of Kaminak Lake, at Padlei (an abandoned trading post). Sites in each set were distributed within about 50 km^2, and samples were taken from the top 5 - 10 cm layer of tundra peat or the mixed organic and inorganic sediment in shallow depressions that intermittently contain water (they dry up during warm summers as, for example, in 1973).

The laboratory procedure was to take about 5 ml of peat or sediment from each sample and treat it in the conventional manner with potassium hydroxide. The coarse plant fragments were removed by screening, and sand by decanting. The fine fraction was then treated with hydrofluoric acid and acetylation mixture (nine parts of acetic anhydride to one part of concentrated sulphuric acid). Slides were prepared of the residue.

The abundance of pollen and spores in the samples studied was low (based on visual examination of prepared slides) as compared with abundance of palynomorphs in similar samples collected further south in the forested regions. Although about a dozen samples were collected both at Padlei and at Kaminak Lake, some of these samples contained few pollen and spores, and only six assemblages from Padlei and four from Kaminak Lake were included in Text-figure 2.

Because of the low abundance of pollen and spores in the preparations examined, an average of assemblages from all sites at Padlei and Kaminak Lake is shown in Text-figure 2. The total number of spruce, pine, birch, alder, and willow pollen has been used as the basic sum for calculating percentages of all pollen and spores in each assemblage.

Discussion

Perhaps the most apparent anomaly of the palynological assemblages obtained from surface samples in the Kaminak Lake area is the presence of spruce (Picea) and pine (Pinus) pollen when compared with the modern vegetation in this area, because Kaminak Lake is about 80 km northeast of the tree line (Text-fig. 1).

Lichti-Federovich and Ritchie (1968) studied surface samples from 14 lakes in the tundra region extending from Hudson Bay to Baker Lake and Dubawnt Lake. Their study indicated that the pollen spectra from this region showed reasonable consistency in the relative proportions of the main types (Lichti-Federovich and Ritchie, 1968; Table II, fig. 2, p. 303-305). The chief pollen types were Betula (20-40%), Cyperaceae (10-25%), Gramineae (1-4%), and Ericaceae (1-4%). Oxyria and Rumex (type acetocella) occurred in low numbers, but consistently, and spruce (6-21%), pine (14-42%), and alder (Alnus, 1-27%) made up a large fraction of the total spectra. It must be pointed out that these percentages of each pollen type were based on a pollen sum of not less than 500 which includes Cyperaceae but excludes aquatic types and spores of non-vascular plants.

It is interesting to note that there is a reasonably good correlation between palynological assemblages obtained by the writer from surface samples of terrestrial deposits in the Kaminak Lake area and those from surface samples of lake sediments described by Lichti-Federovich and Ritchie, in spite of the caution expressed by Ritchie that surface sample pollen assemblages from such different sources could not be directly compared. However, the writer agrees with Ritchie's conclusion that surface sample pollen spectra from lakes are only slightly helpful in distinguishing local tundra types, whereas pollen spectra from terrestrial surface samples reflect much more sensitively the local plant communities. In addition, the terrestrial deposits provide useful paleobotanical information in terms of other plant fossils (seeds, leaves and other identifiable plant remains).

Results of this study suggest that combined surface pollen spectra from both terrestrial and lacustrine deposits probably could be (or perhaps should be) used in investigations dealing with the relationships between the modern vegetation and pollen deposition in the arctic. The present study, furthermore, supports previous statements made by the writer (Terasmae, 1967, 1968) in respect to possible redeposition mechanisms of pollen in the arctic landscape. Since pollen is preserved in terrestrial deposits, some of it can be transported by surface water run-off (that can also derive some pollen through erosion) and redeposited in lake sediments and fine-grained alluvial deposits. It is possible that such redeposition of pollen may account for the similarity of surface pollen spectra from lakes and terrestrial deposits in the tundra region.

Acknowledgements

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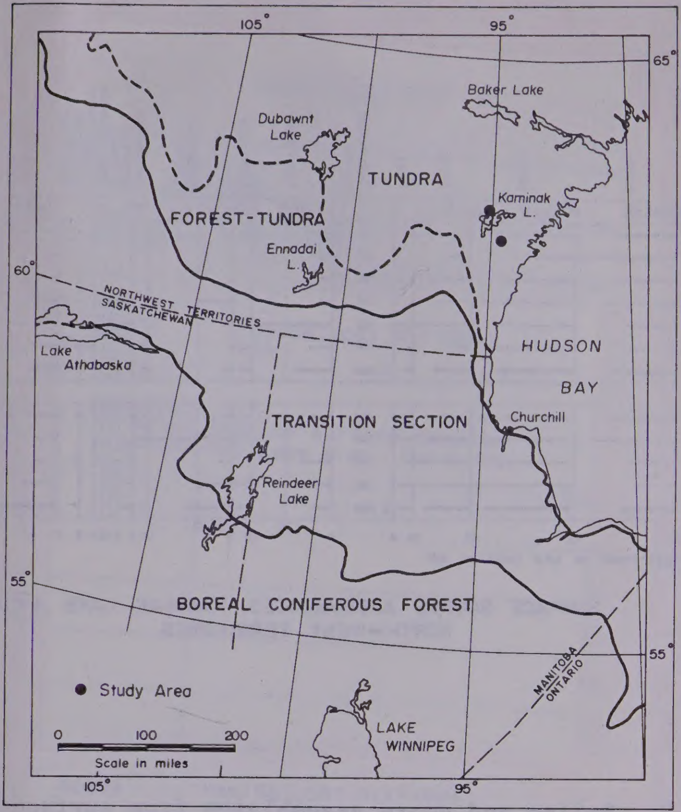
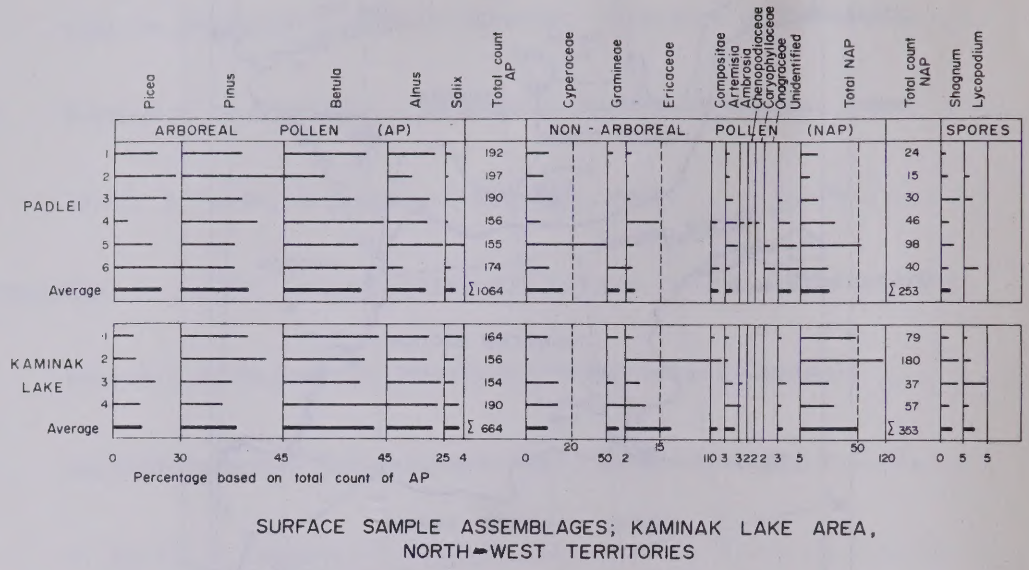


Text-figure 1. Index map, showing boundaries of forest regions (solid lines) and the approximate northern limit of trees (broken line). 100 miles equals 160 kilometers.



Text-figure 2. Pollen and spore assemblages from surface samples of terrestrial deposits in the Kaminak Lake area, Northwest Territories. Percentages calculated on the basis of total counts of arboreal pollen.

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